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CR-146529

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STRUCTURAL AND GROUND PATTERN ANALYSIS OF MISSOURI AND THE
OZARK DOME USING LANDSAT-2 SATELLITE IMAGERY
(Contract No. NAS5-20937)

Co. pi. at
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Second Quarter Progress Report for the Period July - September, 1975.

(E76-10247) STRUCTURAL AND GROUND PATTERN	N76-20594
ANALYSIS OF MISSOURI AND THE OZARK DOME	
USING LANDSAT-2 SATELLITE IMAGERY Quarterly	
Progress Report, Jul. - Sep. 1975 (Missouri	Unclas
Univ.) 11 p HC \$3.50	00247
	CSCI 08E G3/43

Prepared for:

Goddard Space Flight Center
Greenbelt, Maryland 20771

20070

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NOV 26 1975

SIS/902.6

INTRODUCTION

The large number of linear and circular features identified during the first quarter of this investigation have been compiled on a 1 : 1,000,000 scale base map of the state of Missouri (see attached map, somewhat reduced from the original scale). These features were then transferred to 1 : 500,000 scale maps and compared with the distribution of known metallic mines and mineral occurrences (Kisvarsanyi, 1965), with the known and mapped geologic structures (McCracken, 1971), and with ground and aeromagnetic maps (Missouri Geological Survey, 1943). Preliminary results indicate a good correlation between lineaments, metallic mineral deposits, structural features, and major magnetic anomalies.

Ground truth analysis along several lineaments identified during the first quarter has begun, and in several places the lineaments were confirmed to be of structural origin. The number of features identified in this study is so large, however, that complete ground truth analysis will extend beyond the projected 15-month period of this investigation. Full evaluation and interpretation of structural lineaments and circular features will be done when more ground truth data have been gathered.

DISTRIBUTION AND SIZE OF LINEAMENTS AND CIRCULAR FEATURES

The majority of lineaments are located south of the 38th parallel North latitude; several lineaments in excess of 100 miles in length

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extend to the north of this latitude. These large regional lineaments generally strike northwest. The most prominent of these is expressed on the ground as a geomorphic feature, namely, the drainage channel of the Grand River, that continues on strike with a bend of the Missouri River in central Missouri. Several major lineaments of northeasterly strike in the southern part of the state extend into the northern part of Arkansas.

A large number of smaller lineaments have also been recognized in the southern part of the state. These are from 10 to 75 miles in length, and the majority have northeasterly strikes. Circular features are most abundant in the southern part of Missouri. Some of these are more than 25 miles in diameter, but most of them are less than 10 miles in diameter.

The features identified in this investigation display a regularity in pattern. They appear to be important in understanding the regional structure of the state of Missouri, surrounding states, and that of the Midcontinent Platform of the continent. Major rock types of the Precambrian basement, volcano-tectonic features, ore deposits, and major magnetic anomalies are strongly interrelated.

CORRELATION OF IMAGERY FEATURES WITH MINERAL DEPOSITS, STRUCTURAL FEATURES, AND MAGNETIC ANOMALIES

Comparison of the lineament map with the distribution of major mineral deposits (Kisvarsanyi, 1965) at the 1 : 500,000 scale shows a close geographical association. Mineralized areas in the southern part of the state are found on or along lineaments, or near the intersection thereof.

A statistical evaluation of the spatial correspondence of lineaments and mineral deposits will be made later.

A good correlation exists between lineaments and major magnetic anomalies (Magnetic Map of Missouri, Missouri Geological Survey, 1943). In many places, deep drilling indicates that the magnetic anomalies are caused by mafic intrusive bodies in the Precambrian basement (Kisvarsanyi, 1974). Coincidence of a string of magnetic anomalies in northern Missouri with the Grand River lineament, and another series of anomalies west of St. Louis with a major northeast-trending regional lineament strongly suggests deep-seated structural control. The distribution of Precambrian iron ore deposits is also expressed by magnetic anomalies and shows correlation with lineaments identified from the imagery.

Aeromagnetic maps, where available, frequently display excellent magnetic lineaments. In central Missouri, one of these aeromagnetic lineaments corresponds closely with the Decaturville lineament described in the First Quarter Progress Report.

Comparison of the lineament map with the Structural Features Map of Missouri (McCracken, 1971) indicates, that known and mapped structures (faults, anticlines, synclines) correlate closely or exactly with the image-lineaments. Intersections of lineaments in several places coincide with structurally disturbed areas in the overlying sediments (Springfield area, Weaubleau Creek structure, Crooked Creek structure). Geomorphic features, such as river courses and topographic escarpments, in hundreds of places across the state appear to be lineament-controlled.

GROUND TRUTH INVESTIGATIONS

Ground truth analysis of features identified from the imagery has begun but is progressing slowly. To date, the most significant result is that the Decaturville lineament has been confirmed to be a fault zone to the southeast of the Red Arrow fault in Laclede county. In southeast Missouri, additional evidence has been found along the Annapolis and West-Belleview-East Sabula lineaments (Kisvarsanyi and Kisvarsanyi, in press) confirming these to be structural lineaments.

CONCLUSION

It is expected that complete analysis of the imagery covering the entire state will result in a significant improvement in the understanding of the regional structure of Missouri. Results so far indicate, that the major features identified from the imagery have had significant influence on the distribution of natural resources in the state. This program promises to develop definite and specific criteria that will enable investigators to classify areas and structures for locating potential new resources and exploration target areas. It also promises to develop information on the structural control of intraplate mineral deposits within continental areas not related to active plate boundaries.

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PROBLEMS

Due to the delay of the launching of the LANDSAT-2 satellite, LANDSAT-2 imagery started to be received in July, 1975. The quality of much of the LANDSAT-2 imagery did not compare well with that of LANDSAT-1. In many cases, the specified maximum tolerable cloud cover of 20% has been so located on the images as to impede structural analysis in critical areas. Review and evaluation of incoming LANDSAT-2 imagery is a continuing process and we expect to be able to utilize these images to a greater extent through enhancement techniques.

FUNDS EXPENDED

Through the period April-November, 1975, Principal Co-Investigator Dr. Geza Kisvarsanyi, University of Missouri--Rolla (Social Security No. [REDACTED]) is reimbursable by NASA on the basis of the cost-sharing agreement of this contract for 83 of the total 160 hours of work, as specified in the contract.

Missouri Geological Survey team input during the same period amounted to a total of 99 man-hours.

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MISSOURI

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF MISSOURI

Horizontal Scale: 1 inch = 40 miles
Vertical Scale: 1 inch = 40 miles

Scale of Feet: 1 inch = 1000 feet

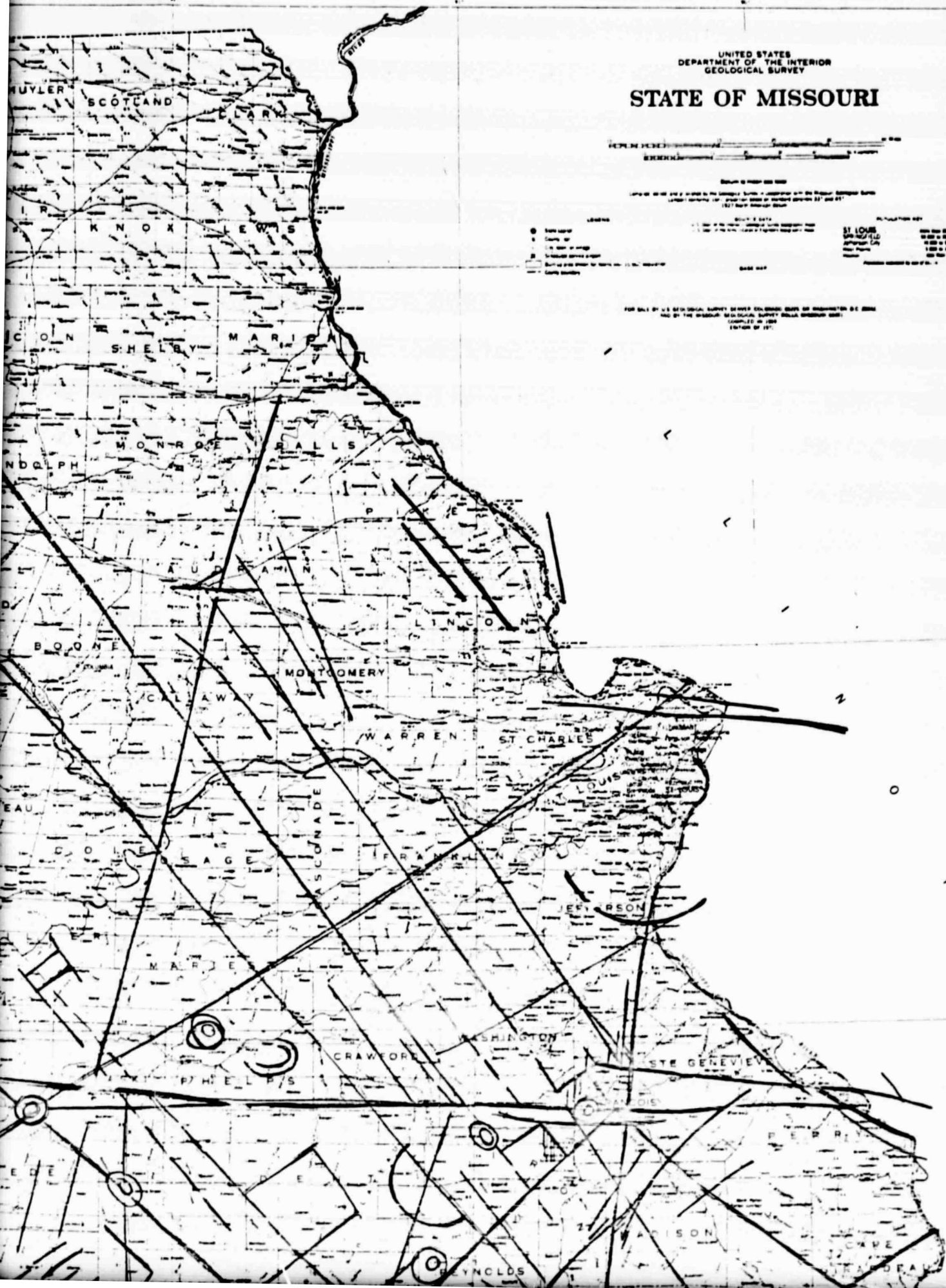
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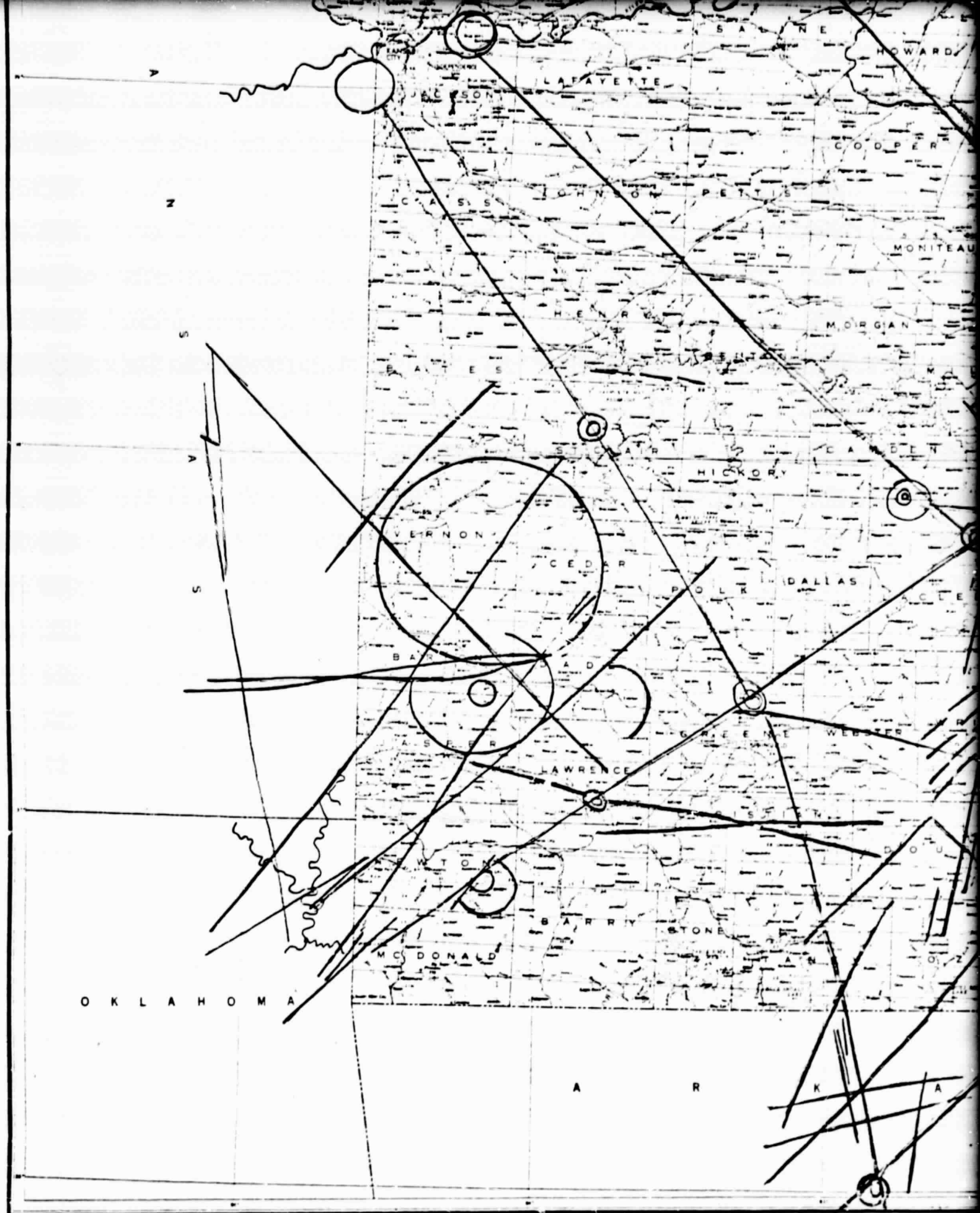
- LEGEND
- Town center
 - County seat
 - Rail line
 - Electric line
 - Gasoline line
 - Water line
 - Sewer line
 - Telephone line
 - Electric power line
 - Gasoline line
 - Water line
 - Sewer line
 - Telephone line
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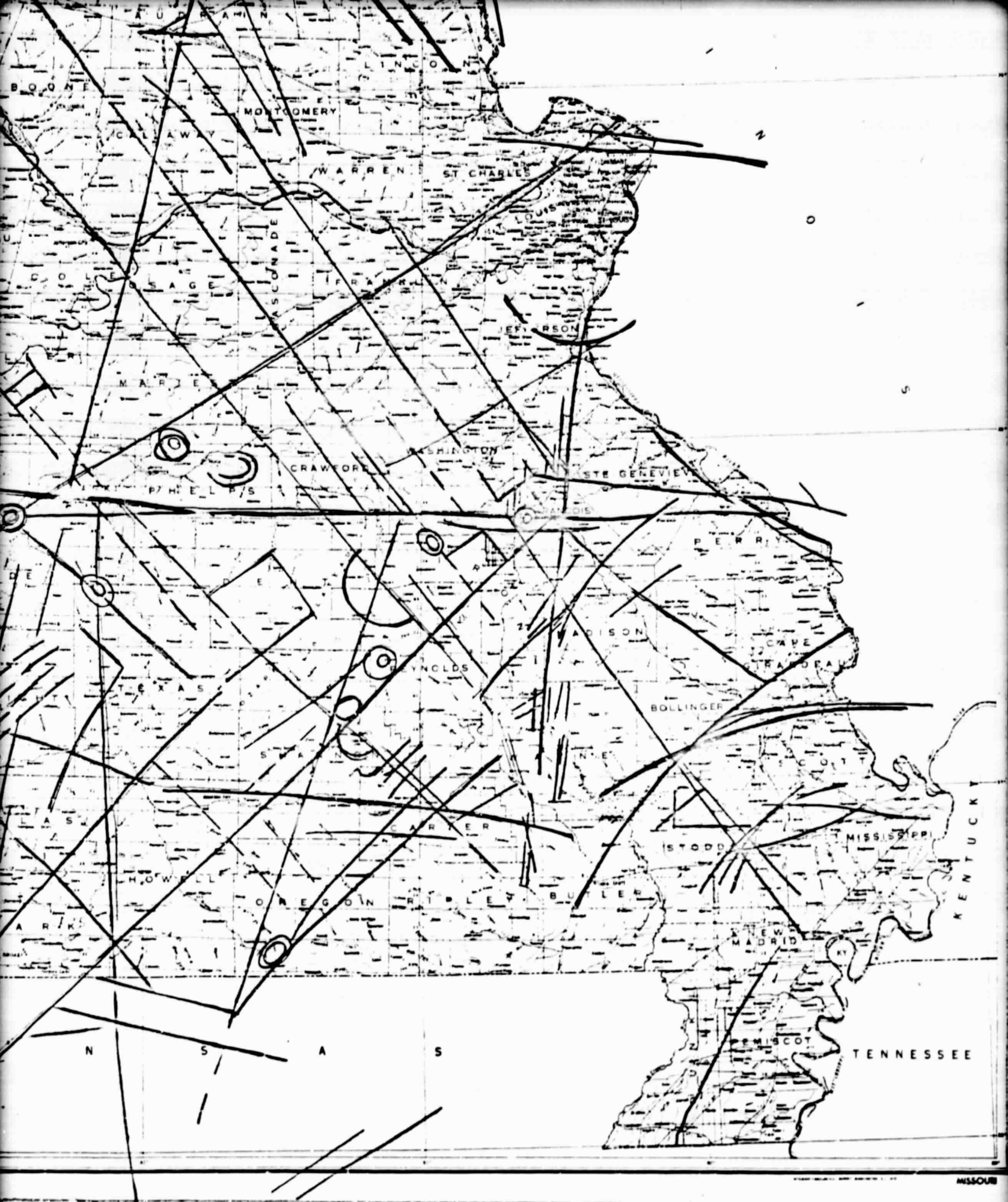
Scale of Feet: 1 inch = 1000 feet

ST. LOUIS
POPULATION 1910
100,000
1920
150,000
1930
200,000
1940
250,000
1950
300,000

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